MOTOROLA INC. Government Electronics Division / Chicago Center

July 24, 1967

Mr. T. Nelsons
Box 1546
Poughkeepsie, New York 12603

Dear Sir:

Your recent inquiry concerning Motorola's TP-4000 Teleprinter is appreciated. For the last five years Motorola's Teleprinters have held a unique spot in the rapidly expanding information processing field, mainly in government applications. The TP-4000 is a compact, typewriter-sized, silent, receive-only printer designed for local or remote hard-copy printout.

In situations where local on-line computer printout is required, printing rates up to 400 characters per second are available. If you've been using ten to fifteen character per second impact printers, you will immediately recognize the increased computer efficiency resulting from an output rate which is twenty-five to forty times as fast.

As a remote printer, the TP-4000 can be interfaced with readily available voice wire modems accepting transmission rates up to 2400 baud (300 characters per second).

1450 N. CICERO AVENUE, CHICAGO, ILLINOIS 60651/(312) 379-6700

Because it was "broken in" on applications calling for high reliability and severe environmental conditions, other important advantages are engineered into every TP-4000. For instance, there are few moving parts, making mechanical maintenance simple (and infrequent). The use of integrated circuits reduces maintenance from the electronic standpoint as well. The paper used in the TP-4000 is, like that used in most non-impact printers, a special type. Unlike other non-impact papers though, no special storage or handling is required. It isn't light sensitive, heat sensitive or moistened, and TP-4000 printing is permanent. It doesn't fade, darken or become brittle before or after use. Because non-impact techniques are used, the TP-4000 doesn't produce carbon copies - the original is readily reproducible by conventional office copiers.

The standard TP-4000 accepts a parallel 7-bit ASCII code - if you have special input code requirements the TP-4000 can probably handle them easily but we will want to talk with you about them before making a quotation.

Presently, we are delivering TP-4000's 120 days after receipt of an order. Pricing varies slightly with the configuration or speed requirements and quantity discounts are the rule. A good starting point is about $8,800, f.o.b. Chicago, for a single system.

If, after reading the attached information, you should like to see the printer or talk about how it can be used in your operations, contact me or the most convenient of the Motorola offices listed in the literature.

Thanks again for your interest, we hope that the TP-4000 can become an important part of your data processing/data communications operations.

Very truly yours,

John Seelinger

John Seelinger
Manager
Teleprinter Marketing

JS/lf

SPECIFICATION FOR. . .

MOTOROLA'S TP-4000 SERIES HIGH SPEED TELEPRINTER

MOTOROLA INC.

Government Electronics Division / Chicago Center

TP-4000 TELEPRINTER SYSTEM
EQUIPMENT SPECIFICATION

1. INTRODUCTION

The Motorola TP-4000 Series high speed teleprinter system consists of two separately packaged items; a printer and a pulse decoder. It is designed to accept digital information and generate hard copy output at selected single speed up to 400 characters per second.

The pulse decoder accepts digital data on a bit parallel, character serial basis and converts these to the pulse pattern which results in characters formed by a 5 x 7 dot matrix as shown in Figure 1. In addition, the pulse decoder accepts data control signals, recognizes control characters, and generates control signals for the printer.

The printer accepts control and print pulse signals from the pulse decoder, takes appropriate action, and converts the print pulses to the proper level (-60 volts and 60 ma) for marking the paper. The control function consists of accepting address signals and advancing the paper and print heads in the proper manner. The marking process occurs when the print head, containing seven styli in intimate contact with a current sensitive paper, is pulsed with a sequence of a maximum of 5 pulses per stylus per character. This results in a 35-dot matrix pattern from which all characters are designed. The printer and pulse decoder use solid state devices exclusively with the pulse decoder using primarily integrated circuits. The pulse decoder uses a core rope for character recognition and dot matrix generation.

Multiple printers can operate with a single pulse decoder. In the standard decoder configuration, up to 11 printers can be operated. Optional decoder configurations expand the multiple printer application to 33. The printers may be individually or group addressed when sharing a common pulse decoder.

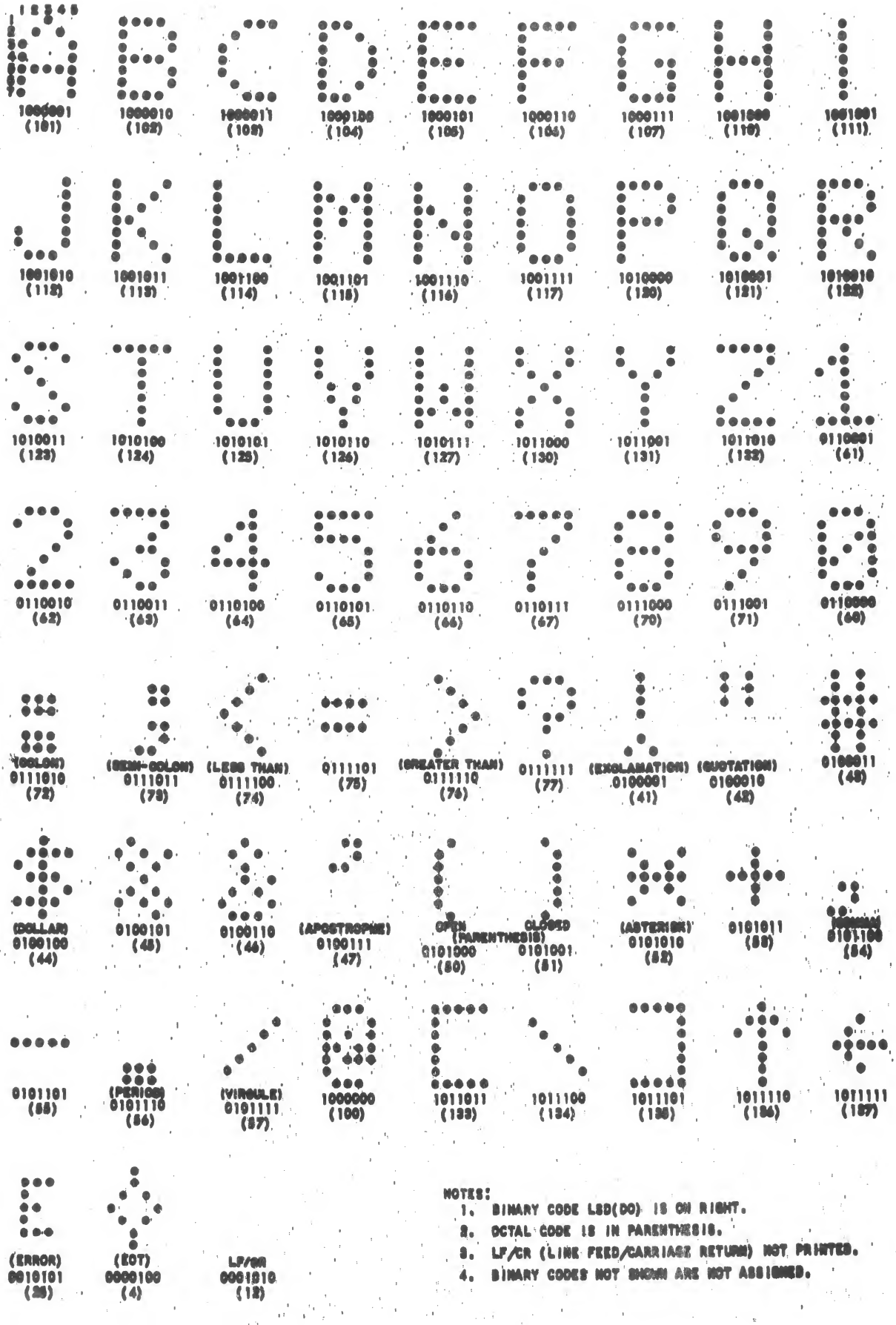


Figure 1. Character Dot Matrix

2. DESCRIPTION

The TP-4000 Series printer and pulse decoder are shown in Figure 2. Paper exits from the top of the machine. All controls are located on a bevel near the front of the machine. The printer and pulse decoder are of modular design with all control and data circuits housed on printed circuit boards that can be tested and fabricated as complete sub-assemblies. Both the printer and pulse decoder require 115V, 60 cps and contain their own power supplies. Two cables are required for signal connections, one for printer to pulse decoder and one for pulse decoder to data source. These cables are not furnished; however, the external mating connectors for the printer and the pulse decoder are supplied with the equipment.

3. DATA INPUT AND PRINT RATES

The TP-4000 Series high speed printer system is available in different data input and print rate configurations. These rates match those rates commonly used with computer and peripheral equipment outputs. Model number and rate must be specifice as follows:

Model TP-4125: 125 characters/second

Model TP-4200: 200 characters/second

Model TP-4225: 225 characters/second

Model TP-4250: 250 characters/second

Model TP-4300: 300 characters/second

Model TP-4400: 400 characters/second

Information on rates not specified above will be furnished upon request.

4. ENVIRONMENTS

The printer system is designed to operate within limited, controlled environments. The operating temperature range is 0°C to 50°C under humidity ranges of 0 to 80% R.H. Shock vibration and other environmental characteristics are consistent with computer equipments of commercial grade.

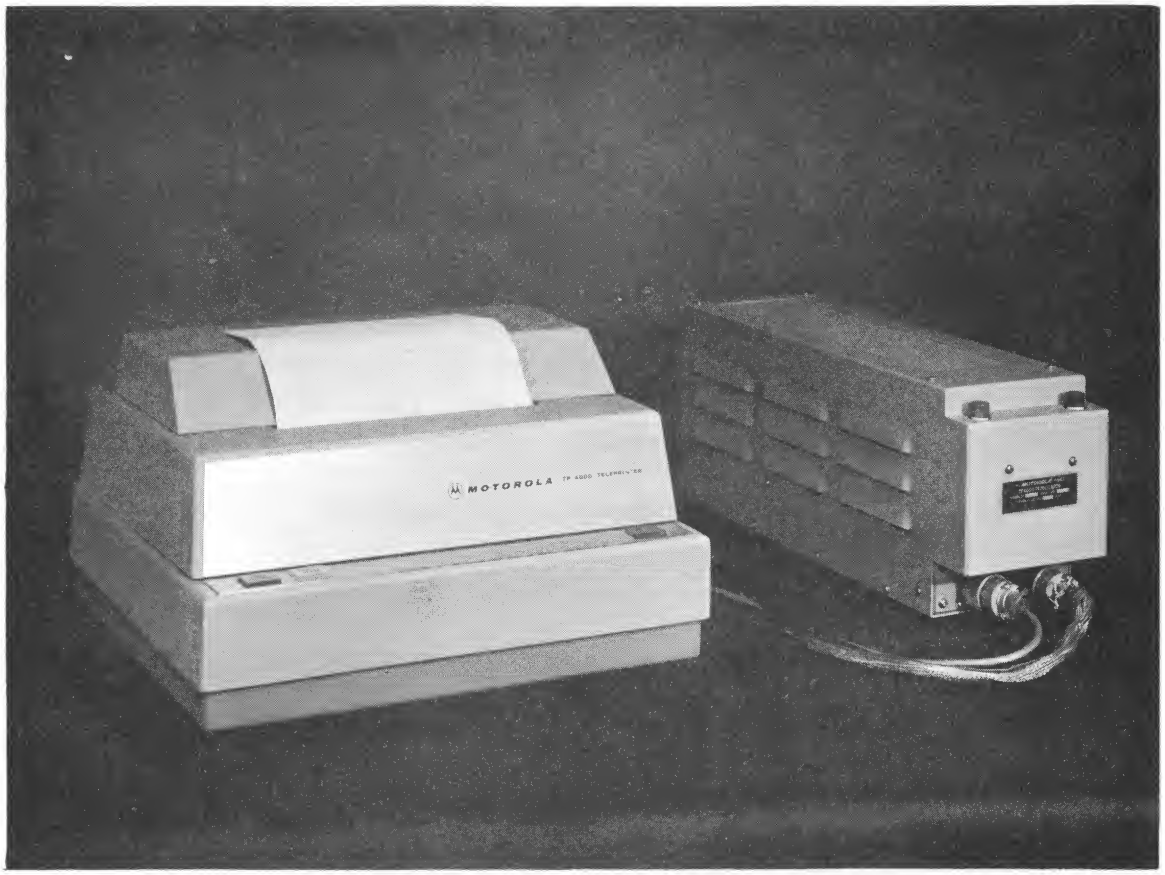


Figure 2 The TP-4000 Teleprinter System

5. CONTROLS AND INDICATORS

All controls are designed for fail-safe operation. When controls are in a condition that prevents successful operation of the unit, all signals to the data source are in the non-receive state with ready level busy, and the printer in alarm state.

A mechanical interlock can be included in the machine so that when the machine is being maintained, an alarm state is indicated to the data source or to operating personnel (optional). For example, if the printer cover is opened by operating personnel for a change of paper supply or for repair, the printer alarm line is in the alarm state. As a standard feature, a low supply of paper is indicated to operating personnel by a red stripe on the right hand edge of the paper for the last 20 feet on the paper roll.

The printer has the following controls:

a) Power-on switch

b) Manual paper advance switch

The manual paper advance is done in such a manner as not to impair the ability of the printer to receive a message. The advance rate is that of the print rate.

The printer has provisions for indicating:

a) Power-on

b) Printer operative (optional)

The printer operative indication means that the printer interlock is in the safe position.

The pulse decoder has the following controls:

a) Power reset switch

b) Power-on switch

The pulse decoder has provisions for indicating:

a) Power-on

b) Ready level

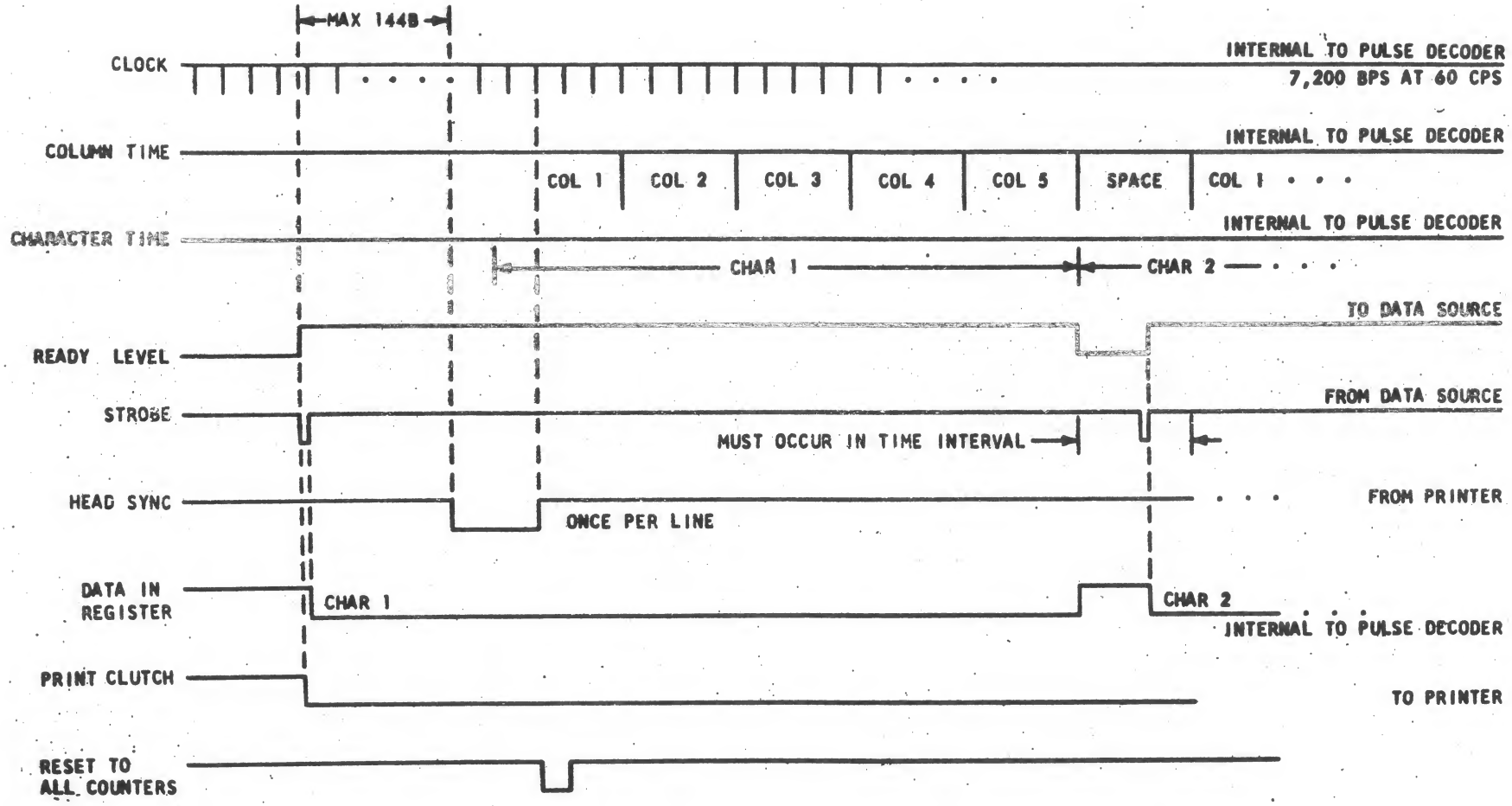


Figure 3. Timing Diagram, Parallel Data Entry (3,000 wpm)

The ready indication means that the pulse decoder is capable of receiving a message.

6. PULSE DECODER OPERATION

Pulse decoder accepts characters serial, bit parallel digital data in accordance with the ASCII code (see Figure 1) on a demand basis. The printer is a synchronous machine and must have new data on demand or it will assume an end-of-text state. The two control characters used in the system are end-of-text (EOT in Figure 1) and line-feed (LF in Figure 1). The pulse decoder is designed to accept 80 characters per line. If the line-feed character is not received as one of the 80 characters on any given line, an automatic line-feed and carriage-return is accomplished with no loss in data. The EOT character is used to signify the end of the message. The pulse decoder is designed so that, after receipt of this character, the ready level stays busy until the end of that line. An automatic EOT is generated internally to the pulse decoder if, in the process of printing a message, the ready level stays ready for two character times without a data strobe pulse. This prevents the printer from running continuously in the event the EOT symbol is either lost in system transmission or is not properly recognized.

6.1 Timing

The pulse decoder is designed to accept digital data at selected single speeds up to 400 characters per second (4,000 words per minute). The following timing example and the timing sequence diagram of Figure 3 are based on a speed of 300 characters per second (3,000 words per minute). At 300c/sec, a character time is 3-1/3 milliseconds. To divide the character time into a matrix pattern there are six column times per character (5 printing and one space). To properly generate each column pulse, each column time is divided into four clock counts. The 60 cps line frequency is used as a timing reference. This is done in the printer by the use of a line synchronous motor. In the pulse decoder this is accomplished by the use of a shaft encoder (a timing wheel driven by a small line synchronous motor). The timing wheel will yield 7,200 bits/second (4 per column line) at 300 c/sec. If there are long-term drifts in the 60 cps reference frequency, both the printer and the electronics will drift together, maintaining synchronism. Momentary changes wich might occur in the 60 cps supply will be partially dampened out by the inertia of the system. In addition, the response of a

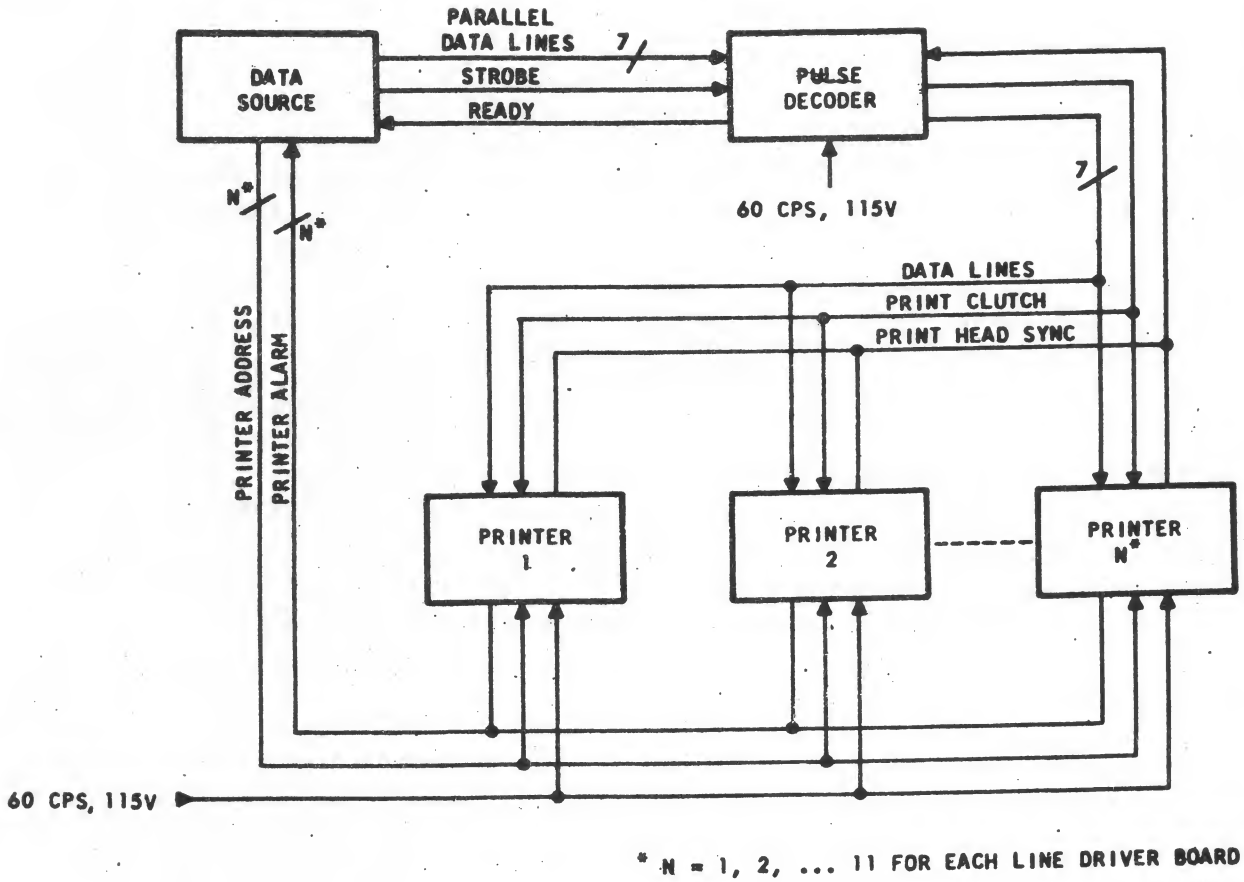


Figure 4. Equipment Interconnection

synchronous motor to frequency changes is about one cycle (17 milliseconds). When this short response time and the inertia are considered, the most serious effect that can be anticipated from such abrupt changes is a slight compression or expansion of a few characters.

A head position detector is located on the printer. This signal will signify that a print head is in position to begin printing the next line. The outputs of all printer head position signals, for multiple printers from one pulse decoder, are bussed so that the first response is used to gate the data processing. The clutch responses are designed to be within one character time of each other. At this time, a print head on each printer is in contact with the paper. The differences in response will be reflected in a relative shift in the margin with no loss in data. However, these differences can be adjusted to an imperceptible level by adjusting the head position detection. The timing diagram (Figure 3) is for a standard parallel data entry, ready-strobe. It should be noted that the first print head sync response will occur within 6 character times (or 44 bits of clock) after receipt of the first strobe of each message. Since the print heads are spaced 90 character intervals apart, there will also be 4 unprintable character times at the end of each line. After each head sync pulse, the character counter will count to 80 and stop. Ten character times later there will occur another head sync pulse starting the counting process over again.

The data rate from the source in this example is 300 c/sec with the line frequency at 60 cps. By changing the speed of the head drive shaft (through a gear ratio change) and the timing disc in the pulse decoder, the rate can be normalized to any single speed.

6.2 Pulse Decoder Power

The pulse decoder requires 115V, 60 cps. The maximum power drawn from the line is 57.5 watts resistive.

6.3 Pulse Decoder Interface Signals

The interface signal levels between the data source and pulse decoder and printer and pulse decoder are given in the following paragraphs.

6.3.1 Data Lines and Strobe Lines

The input data lines must deliver to the pulse decoder circuits the following signal levels:

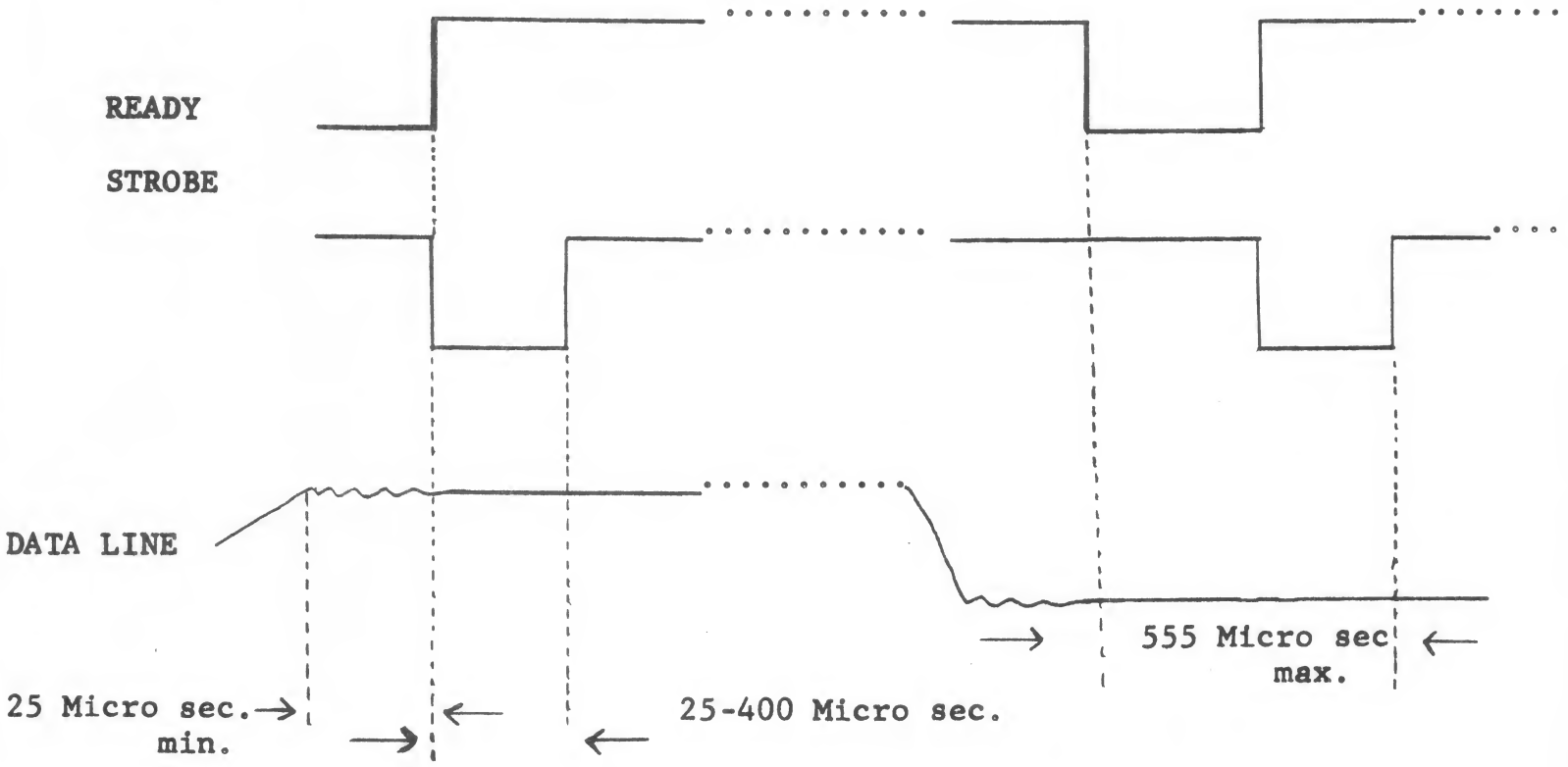
(Next Page)

For Logical 0: Nominally 0V with a tolerance of -.3V and +1.5V

For Logical 1: Nominally -4V with a tolerance of +0V to -1.5V

Input impendances are 330 ohms ±10%.

The current required is 10 milliamperes minimum. The rise and fall times must be each 6 microseconds maximum (see Figure 5 for line receiver circuit). The following relationship exists:



The strobe pulse must occur after each new character is placed on the data lines (allowing for quieting time). Its pulse width is 25 microseconds minimum and 400 microsecond maximum. The trailing edge of the strobe pulse is uded to gate the data into a one character register located in the pulse decoder. The data can be switched any time after the trailing edge of the strobe pulse, except that the data must be switched at least 25 microseconds before the leading edge of the next strobe pulse, and must be stable before the leading edge of the next strobe pulse.

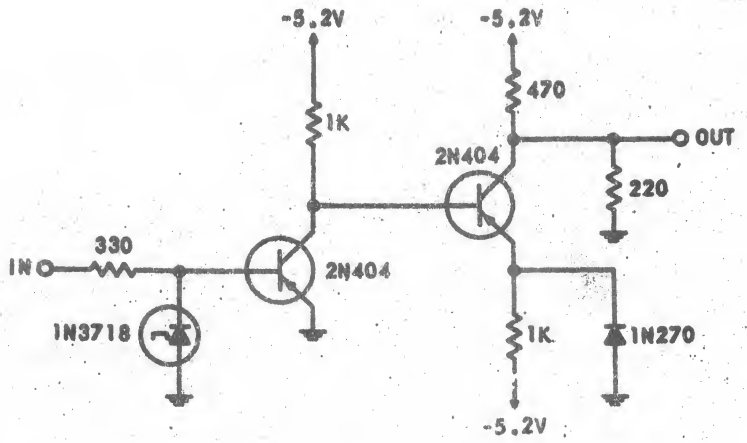


Figure 5. Line Reciever

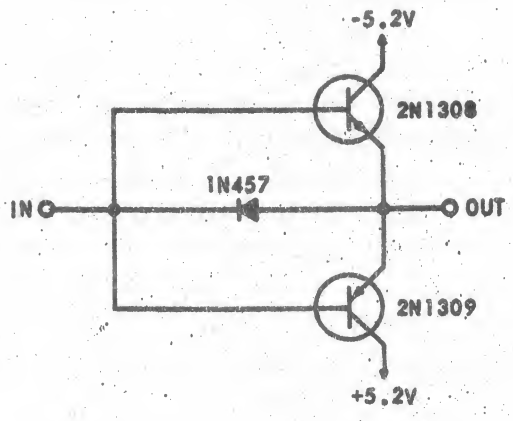


Figure 6. Line Driver

6.3.2 Ready

The pulse decoder will output a ready level as follows:

Ready: -4V ± 0.5V

Busy: -5V ± 0.5V

The rise and fall times will be each 6 microseconds maximum (see Figure 5 for line driver circuit). The ready level will go "busy" at the trailing edge of the strobe pulse.

7. PRINTER OPERATION

The printer is designed to print 80 characters per line in a length of 7.2 inches. Line spacing is 6 lines per inch and paper width is 8.4 inches. The printer line synchronous motor (and driven gear) is the only moving part in standby operation. Upon receipt of a print clutch signal from the pulse decoder and a printer addressed signal from the data source, the print clutch is inergized releasing the drive power from the line synchronous motor to the paper advance drum and print head drive pulleys. At rest, the print head is slightly retarded from the start print position. Upon both the print head and the paper being accellerated to printing speed, which takes less than 6 character times, the print head position sensor generates a head-sync pulse for the pulse decoder. This triggers the data processing circuits in the pulse decoder beginning printing for that line. There are four print heads on each belt assembly spaced precisely one line time apart (90 characters). Thus, at the completion of the print line for each head, another is in position to start the next line and another head-sync pulse is generated. This process is repeated until the end-of-message character or condition is sensed causing the print clutch to be de-energized. This mechanically disengages all driven elements from the line-synchronous motor placing the printer in the standby condition. The printer also contains the circuits to amplify the print pulse signals from the pulse decoder.

7.1 Printer Power

The printer requires 115V, 60 cps. The maximum power drawn from the line is 115 watts.

7.2 Printer Interface with Data Source

7.2.1 Printer Alarm (Optional)

The optional printer alarm output will be:

Logical 0 (Non-operative) : 0V ± 0.5V

Logical 1 (Operative Condition) : -4V ± 0.5V

7.2.2 Printer Address

The printer address signal must be applied for the entire length of the message (from first strobe until EOT is transmitted to the pulse decoder). This signal is generated by the data source for multiple printer applications. For single printer applications, or for those applications requiring that all printers print the same message, the print clutch signal which is generated by the pulse decoder can be used for both print clutch and printer address by making a jumper connection. The signal required at the printer is:

Logical 0 (Not Addressed): -0.5V ± 0.5V

Logical 1 (Addressed) : -4V ± 0.5V

7.2.3 Printer to Pulse Decoder Interface

The signal swings will not exceed 5 volts at 250 milliamperes.

8. OPTIONS

The following options are available. Additional details will be furnished upon request.

8.1 Paging

Paging the paper so that the last line printed has cleared the machine can be handled by programming the message format or by electronic means. A paging circuit option is available, that will advance paper so that the last printed line has cleared, by sensing the end-of-text condition.

8.2 Rack Mounted Pulse Decoder

If the installation situation required that the pulse decoder be rack mounted, then the necessary hardware is available for this purpose. Switches and indicating lamps that are mounted on the translator will be furnished loose for mounting in any convenient remote location.

8.3 Codes

Any six or seven level code for up to 66 printable characters and two control characters, such as end-of-text and line feed can be accommodated. Quotations will be furnished upon request.

8.4 End-of-Paper Alarm

Paper used in the TP-4000 Series Teleprinter is red-striped on the right-hand edge of the paper for the last 20 feet on the roll. An alarm circuit option is available which provides a dry contact closure for connection to user furnished power source and bell, light, etc.

SYSTEM CHARACTERISTICS

	PHYSICAL CHARACTERISTICS			
NOMENCLATURE	WIDTH	DEPTH	HEIGHT	WEIGHT
Translator	17.5 in.	7-1/2 in.	5-3/4 in.	17 lbs.
Printer	16 in.	13-8/8 in.	9-1/2 in.	40 lbs.

CHARACTERISTIC	DESCRIPTION
PRINTING RATE:	Model TP-4125 125 characters/second Model TP-4200 200 characters/second Model TP-4225 225 characters/second Model TP-4300 300 characters/second Model TP-4400 400 characters/second
INPUT CODE:	6-bit or 7-bit parallel code.
CODE KEY:	Refer to the dot structure of printed characters diagram
POWER REQUIREMENTS:	
Translator	115v ac, ± 10%, 60 ± 2 cps, single phase, 57.5 watts
Printer	115v ac, ± 10%, 60 ± 2 cps, single phase, 115 watts
ENVIRONMENTAL CONDITIONS:	
Operating:	
Temperature	0°C to +50°C
Relative Humidity	0 to 80%
Altitude	Sea level to 15,000 feet
Nonoperating:	
Temperature	-20 to +160 degrees F
Relative Humidity	0 to 100%
Altitude	Sea level to 35,000 feet